CAUSES OF SUDDEN DEATH.

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The material which comes the way of the forensic pathologist differs in many important particulars from the cases which one is accustomed to deal with in hospital and private practice. In the latter the patient has, so to speak, been dying before one's eyes and one has usually some idea, more or less precise, as to the cause of death. In the former set of circumstances the first thing one is confronted with is sudden death in the course of apparent good health or some apparently trivial ailment. Indeed, by convention unexpected death is what is meant by sudden death, for strictly speaking all deaths are sudden.

Sudden death is uncommon in hospital but is almost the rule in the work of the forensic pathologist whose list of causes of death will therefore be of a somewhat special kind. Certain conditions generally regarded as rarities would not seem in reality from forensic experience to be rare at all; conspicuously I may mention acute hæmorrhagic pancreatitis and ruptured heart. In this work ruptured heart (including for convenience in this term, ruptured first part of aorta) is more common than cerebral hæmorrhage. Of all inaccurate diagnoses in cases of sudden death, cerebral hæmorrhage easily heads the list. For some obscure reason the amount of authority for regarding a sudden fatal "stroke" as a cerebral hæmorrhage is colossal, but a little reflection and some remembrance of what we see in hospital should guard one against an error so gross; for people do *not* as a rule die *suddenly* from cerebral hæmorrhage. The majority of patients with cerebral hæmorrhage take hours or even days to die.

Age Groups.

All causes of death bear some relation, but not a rigid one, to age. The probable differential diagnosis will differ at different ages and hence I propose in my discussion of the question, to consider *seriatim,* the commonest causes of sudden death found in ascending age groups. I arrange my age tables first in hours, then in days, then in weeks, then in months; then in the first and second years; then from the second to the fifth years; and then in the heptads 6-13, 14-21, 22-28, and so on.

Asphyxia Neonatorum. I think that Medicine will have to proceed to a simplification of nosology in that some conditions will eventually come to be lumped together; and this is particularly true of this condition. When an infant is born with the cord fairly tight round its neck and dies a few hours, or even a day or so, later, the cause of death recorded will depend a good deal on the thoroughness or otherwise of the examination. If one examines the adrenals, and few can honestly say they do this as a routine—although of course those who hold themselves out as experts have to—one will find blood in them and be tempted immediately to write an article on adrenal hæmorrhage without stopping to ask oneself: "How many other adrenals have I examined and in how many other conditions?" There is always hæmorrhage into the adrenals in this condition. Subtentorial hæmorrhage will of course not escape you unless you have been so unwise as to let any but the most experienced assistant remove the brain. What interests me about the latter finding is that it can be found without any

instrumental interference and not infrequently with a very severe degree of cerebral engorgement by the cord being wound round the neck and I have come to regard that also as an asphyxial phenomenon.

Next in order will be **icterus gravis neonatorum.** Everyone is familiar with the fugitive icterus of infants, but some get yellower and greener and die. The cause is not settled but I have done some work to shew that it is a hæmorrhagic process due to a profound non-suppurative infection through the umbilical vessels.

Atelectasis we get at a little later stage. The infant does not get full breathing power in its lungs for some weeks and one may find, in cases dying from other than lung conditions, that varying parts of the lungs are not aerated. It is a question of the amount of lung tissue involved.

Marasmus. Leaving infants that die in a matter of hours or days and coming to those that die in weeks, one is bound to assert, in spite of the Registrar General, that there *is* such a condition as marasmus. It is perfectly familiar to pædiatricians who now call it, since the Registrar General objects to the term marasmus, athrepsia. The condition is more common in artificially fed than in breast fed children and commoner still amongst premature infants. One invariably finds a hypoplasia of the intestinal tract so that it is possible to read print through the colon (unless fluids have been given to excess and the tissues, including the colon, are waterlogged).

While on the subject of artificial and breast feeding, a little post-mortem work will shew that infants always inhale food. If they inhale the maternal milk, little or no harm results: they have something absolutely aseptic and non-irritating. But if they inhale artifical food, the result is likely to be different ; for not only is the food not entirely aseptic but it is more irritating than the maternal milk.

Generally on the subject of food in the air passages post mortem, be slow to attribute death to this cause and remember that frequently at all ages there may be vomiting before death and food drawn into the air passages in agonal inspirations ; so that what has happened is that deceased has drawn food into his air passages because he was dying and has not died because he has drawn food in. In such cases no local reaction will be found. A similar explanation is usually the correct one where in fatal cases of strangulated hernia, or other intestinal obstruction, liquid fæces are found in the lungs. Some surgeons make a practice of washing out the stomach before undertaking such an operation.

Capillary Bronchitis. We now come to the most important single cause of sudden death in infants. It may occur at any time in the first year of life and sometimes in the second. The infant will be found dead in its cot and it will be thought that it has suffocated. Many such cases are signed up as *overlying,* though even if it had suffocated the term would be a misnomer as it is meant to apply to cases, now rare, where the mother has taken the babe into her bed and lain on him. In the above cases a very diffuse bronchiolitis will be found unless signs of mechanical asphyxia are present and the child has actually suffocated on a soft pillow : not common in my experience. Many of these children, especially if attacked later in the period under consideration, are podgy, lymphatic infants who win prizes at baby shows. Such need careful watching especially when put out into the open air in cold weather and at the first sign of difficulty in breathing should be brought in. You cannot wrap a shawl round the bronchioles.

Bronchopneumonia. Succumbing less rapidly but often very suddenly are infants from whom no other history can be obtained from the mother than that the child had "a bit of a cold"; yet a confluent bronchopneumonia out of proportion to the severity of the symptoms, and sometimes even eluding the stethoscope, may be found. Here, as indeed with capillary bronchitis also, and whether the death was sudden or not, the bacteriology of the case is important. One should not be content with the diagnosis of bronchopneumonia alone but should ask oneself is the condition influenzal, diphtheritic, streptococcal or pneumococcal? True influenza may, as is well-known, kill with extraordinary rapidity at all ages, but it is not so well-recognized that diphtheritic bronchiolitis and bronchopneumonia may attack infants and young children in apparently fulminant fashion. In these cases, where there is usually some malaise, a throat swab may be returned negative but the organisms will be found in the nose, skip the fauces and be found in the bronchioles. The curious will find some interesting cases in my note on Extra-faucial diphtheria*.

Perforating Appendix. Quite the greatest surgical catastrophe of early childhood, in my experience, is this condition in which so great is the euphoria that I have seen cases with a belly full of pus who on certain testimony were running about playing the day before. The difficulty resides in the different pathology of true inflammation of the appendix and necrosis; so much so that an experienced surgeon has said: "When you go to see a case of 'appendicitis' leave your thermometer behind."

The Meningitides. The diagnosis of this condition is at times difficult enough even with symptoms, for diseases have a nasty habit of not respecting the symptomatology of the textbooks. Do not, in particular, label an infant as gastro-enteritis merely on account of diarrhœa and vomiting but do a lumbar puncture. Unexpected death may manifest itself in children, but more often in young adults, after a short period of mere malaise, conspicuously in influenzal, meningococcal and tubercular meningitis.

Lymphatism. One cannot leave the thanatology of childhood and adolescence without some mention of this condition, vouched for by men all over the world experienced in the elucidation of the causes of sudden death but the existence of which, I understand, is denied by a Government committee. To say, for instance, that there is no such condition because the diagnosis of it has been abused is as though one should say that there is no such thing as influenza. I may say at once we come across it only occasionally and the inexperienced are strongly advised when they think they have come across a fatal case to consult a forensic pathologist. It occurs, although it is a rarity, about the ages of 5 and 15. At the former age you have your warning during life, for you will find precocious skeletal development so that the child will be tall enough for 7, will be well-covered and have exuberant tonsils.

Precocious Fibrosis of the Heart. This condition merits special mention. I have seen it several times, in about 1 in 1,000 of my cases. It seems to occur in young women of about 17 and young men of about 24. They are of athletic

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build and temperament but are remarkable for the smallness of the heart and aorta considering the size of the body, though ironically, they are very energetic and even very athletic. Put simply, the vascular system is too small for the body. Some thymus tissue usually persists. The circumference of the aorta will be 1 in. or even less, instead of the normal $1\frac{3}{4}$ ins. to $2\frac{1}{4}$ ins.

Pulmonary Embolism. In the age group 22—28, female deaths preponderate greatly over male due to the incidents of pregnancy or attempts to prevent it. I agree with Spilsbury that pulmonary embolism is not necessarily, or even commonly, associated causally with sepsis. It is liable to occur in certain types of persons who have to, or in fact do, remain immobilised after trauma. It will be realized of course that under trauma we must include Nature's trauma in even natural delivery. White leg appears apart from sepsis, so that sepsis when present is a coincident. The special type of person affected is somewhat or frankly obese, has a low blood pressure and except for the child bearing period usually of middle age. Post mortem, there is hypoplasia of the aorta (not so marked as in precocious fibrosis of the heart) and of the thyroid. I have indeed noticed that the majority of maternal fatalities of all kinds either lack the physiological hypertrophy of the thyroid of pregnancy or shew hypoplasia or frank colloid degeneration of that organ. Learn to distinguish a true embolus or thrombus from agonal clots; and do not presume that the thrombus has come from such and such veins: dissect them. Cases, which are in reality examples of pulmonary thrombosis are not infrequently labelled pulmonary embolism: here the arrangement is much more symmetrical and extends tree fashion.

Coronary Stenosis and Aortitis. This is found from manhood to early middle age and is usually syphilitic. I never call it so on mere inspection although the probabilities at these ages are very high. Be careful not to call the aortitis of the old, syphilitic: it is unfair and usually inaccurate. Aortitis tends to stenosis of the coronary ostia.

Aortic Stenosis. This condition is responsible for a large number of deaths from early middle age to old age. It is associated with hypertrophy of the heart: the greater the hypertrophy the shorter the life, the youngest being the comparatively enormous hypertrophies met with in the rheumatic carditis of children and young adults.

Fatty Degeneration of the Heart. This is conspicuous in the age group 50—56 and is commoner among women than men. It may be found in the early, but not in late, old age as will be explained later. The grossest form of fatty heart is found in alcoholism and forms part of the triad I require for alcoholic death viz.: fatty heart, kidneys and liver: the association is very striking. Many a man has been libellously labelled an alcoholic because of cirrhosis of the liver alone. Remember that cirrhosis of the liver occurs in children and animals; and indeed the oldest tiger at the Zoo died of it the other day.

Coronary Thrombosis. I feel inclined to say with regard to this condition what the late Lord Justice Darling said of the "smart set": "I have been trying for years to trace the whereabouts of this mysterious organisation." I must have cut up about a mile of coronary artery but only find a true coronary thrombosis occasionally. Perhaps it is more frequent in hospital and private

practice than in forensic. It tends to occur, when it does occur, between the ages 50 to 70. Agonal thrombi will form in the coronary arteries as they will elsewhere but then it is clear that the blood will have clotted because the patient was dying rather than that the patient has died because the blood clotted. You might as well kill your patient with aortic thrombosis! The true thrombi I have found have been in connection with the pultaceous material sometimes seen on atheromatous patches. I am persuaded that the coronary thrombosis often diagnosed during life, and miraculously recovered from, is a form of temporary slight dilatation of the heart such as we saw in the recoverable disability of soldier's heart.

Coronary Atheroma. This condition on the other hand is a very definite affair and shews during life, but by no means always, angina pectoris as a symptom by which name it is quite unobjectionably known. There may be no pain or the pain may be in the testicle or anywhere and even a laparotomy may be performed for its relief. Frequently the patient complains of indigestion and quantities of bismuth are given; indeed I must not be thought to be cynical when I say that one of the post-mortem findings is signs of bismuth medication. It would ill become me to be cynical for our work teaches us to have a ready and constant appreciation of the difficulties of the clinician. Post mortem, the signs are very characteristic and before ever the heart is reached, pulmonary œdema and œdema of the small intestine will be noticed and, if there is solid food in the stomach, it will be found that some of it has made its way into the duodenum: otherwise, except occasionally in fatty degeneration of the heart, the pylorus remains closed. On dissection of the heart, occlusive atheroma of the coronary arteries will be found. A common site is the junction of the descending and coronary branches of the left coronary artery where a plaque may strip off and occlude the lumen hinge-fashion. I have learned to look without suspicion on coronary arteries that are tortuous and roomy, as in the aged. On the other hand, if the victim of coronary atheroma already has vascular hypoplasia, death will occur at a comparatively early age. Coronary atheroma is commonest between the ages 57—63, less common from 64—70 and rarely seen (of the occlusive type) after that; so that if one can escape fatty degeneration at middle age and coronary atheroma in late middle and early old age, the chances of longevity are great and the patient succumbs to ordinary senile myocardial degeneration, ruptured heart, uræmia or acute bronchitis.

Fibrosis of the Heart. If syphilitic, this condition will kill in early middle age; otherwise it does not appear at all frequently until late middle and, more commonly, early old age.

Fibrofatty Degeneration of the Heart. It is the fashion nowadays to say that old people die of myocarditis. The only kind of inflammation found about the heart in the old—and at the other extreme of life, in infants—is pericarditis. Otherwise the lesion is a degeneration and if we persist in calling it an *—itis* we reach a situation in which we lose sight of the plain meaning of words. An 'itis' is an inflammation and the few true inflammations of the heart we are familiar with are incompatible with long life. Nor do they commonly attack the old. The same objection holds with regard to 'chronic interstitial nephritis' which is a degeneration and not a demonstrated inflammation. The French more logically

call the latter condition, sclerous kidneys and so do I. To return to the fibrofatty degeneration of age, it would seem that if enough fibrous tissue can be found to scaffold the fatty degeneration which begins in middle age, that period may be survived and long life enjoyed unless the fibrosis is excessive.

Arteriosclerosis. No mistake is more common than to imagine that this is a necessary accompaniment of high blood pressure and of old age. In my experience, hyperpiesis is associated rather with rubbery arteries and muscular arterial hypertrophy and I have seen many such fatal cases in middle age without a trace of atheroma. Atheroma certainly tends to appear with advancing years but so long as the cerebral arteries escape, a long life may be lived. In particular the basilar artery of an old man—with atheroma elsewhere—may be as soft as that of a child. If, however, the cerebral vessels sclerose, fatal cerebral œdema may occur in early old age. The oldest subjects I have dissected have all been remarkable for one thing, viz., the healthiness of the thyroid gland, so that the physician who described it as the gland of life was in my opinion not far out. Many more forms of degeneration of the thyroid are to be noticed on careful examination than have been described ; it happens to be the first organ I examine in the routine I adopt (after the tonsils). A chronic toxic process never spares the thyroid and some are so unfortunate as to be congenitally subthyroidic. Whether this submyxœdema is congenital or acquired, the subject is very intolerant of toxins —bacterial or chemical—and of shock and may succumb under an anæsthetic for some trifling operation or in normal labour.

Uræmia. The grosser manifestations of this condition are not within the purview of this article ; a diagnosis will have been made and death expected. Gross degeneration of the kidneys occurring early is incompatible with long life but if the onset be gradual, say from late middle age onwards, a high degree of compensation is reached and old people will be found with kidneys that one would think ought to have killed long ago. These are liable to uræmia so acute as to come under the rubric sudden death. Do not forget that uræmia may be precipitated by trauma at any time if the kidneys are grossly degenerate.

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